agriculture

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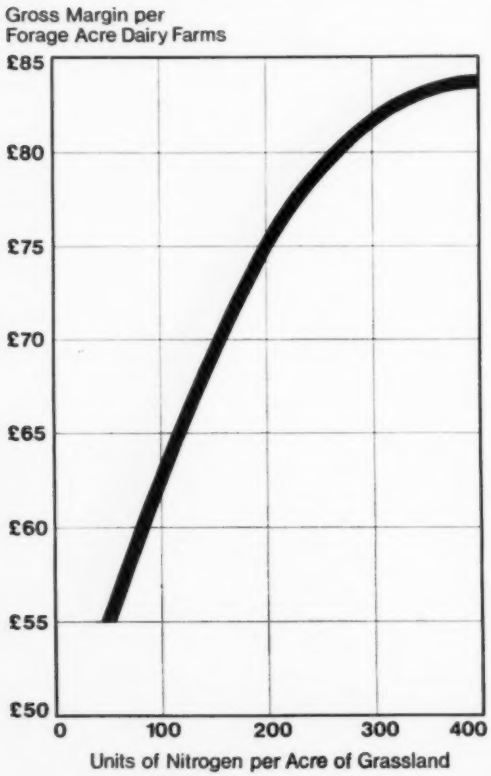
Nitrogen-

The key to profitable milk production



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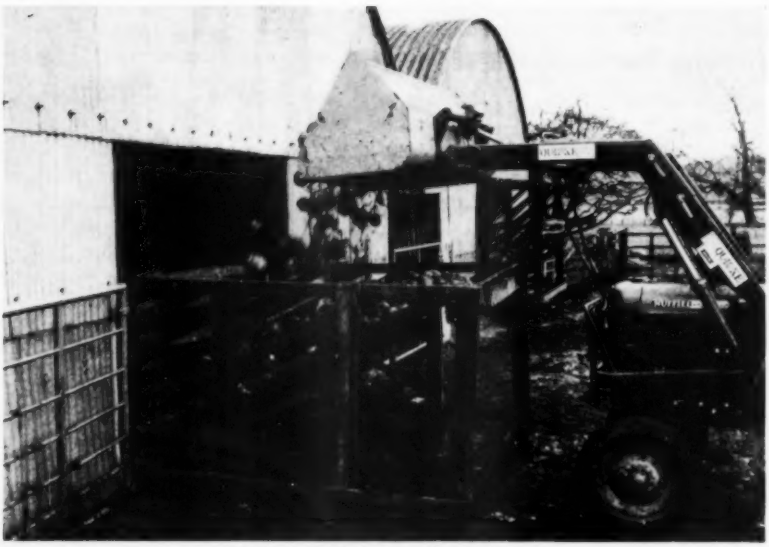


Loading swedes into a self-feed hopper

Swedes in the Seventies

—a fully mechanized break crop

John Rhodes

DURING the nineteenth century fodder roots were the king-pin of arable rotations. They provided a cleaning break and introduced fertility from folded sheep—the golden hoof. Roots were also pulled by hand, clamped and fed to yarded stock during the winter.

Since the 1890s farm wages have soared, systems have changed and new stock feeds have become available. As a result, the root acreage has declined dramatically. In 1874 there was 1,633,000 acres of swedes in England and Wales and by 1964 this had fallen to 145,000 acres. By 1970 the acreage of turnips, swedes and fodder beet in England and Wales reached an all-time low of 106,491 acres. Since then there has been an increase, particularly in the Welsh Borders, the North East and North West, resulting in a small increase nationally to 107,554 acres in 1971. So perhaps the trend has changed.

Most of the root acreage is to be found in the more humid west and cooler north country, where the crop is extensively used for fattening store lambs and wintering ewe hoggs. This can be very successful and produce gross margins of up to £60–£70 per acre (R. Hart, *Agriculture*, July 1969). Roots are also pulped or fed whole to yarded and outwintered stock; this practice is largely found in the more traditional livestock-rearing areas of Britain.

Growing and harvesting the crop

Today swedes need no longer be a labour-intensive crop. They can be sown as late as the end of May, or even later if some yield loss is accepted. Sowing after the third week in May reduces the yield of roots, but later sown swedes may escape mildew and therefore store better. Thus there is ample time to work the ground well and prepare a stale seed bed, the final working down being done three weeks before drilling; the weeds that germinate can then be sprayed off with a contact herbicide immediately before drilling the swedes. Provided that no further soil disturbance takes place there will be little re-growth of broad-leaved weeds.

The stale seedbed technique using a contact herbicide to kill the weeds at the time of drilling is the cheapest and probably the most effective system of weed control now available. However, where this method is not possible the more expensive residual herbicides now on the market can be used. Use of precision seeders at a seed spacing of 7 in. or 5 in. eliminates the need to thin. The seed rate at these spacings is about $\frac{1}{2}$ to $\frac{3}{4}$ lb per acre depending on row width. Graded seed is essential and should be dressed with a combined fungicide/insecticide dressing. Row width depends on the method of utilization. For grazing, 18-inch rows are suitable, but for harvesting, wider rows (20 in. to 24 in.) will be necessary.

Fertilizer requirements are 40–60 units per acre of nitrogen, up to 125 units phosphate and 50–60 units potash. Balanced root fertilizers are available and these often contain boron which is necessary to reduce the incidence of 'heart rot'. Boron deficiency is most likely where soil pH is high. The variable costs of growing the crop are £5–£14 per acre, depending mainly on the amount of fertilizer used.

Special harvesters for mounting on the 3-point linkage of the tractor are available. These top, lift and elevate into a trailer a 30-ton per acre crop at the rate of about one-third of an acre per hour. Such machines cost about £450 and can be shared by a number of growers to advantage.

Comparative crop yields

In terms of feeding value per acre, swedes have great potential:

	Crop Yield	*S.E. Yield*	*D.C.P. Yield*
	per acre	per acre	per acre
Hay (average quality)	40 cwt	12 cwt	1·4 cwt
Silage (average quality)	8 tons	16 cwt	3·2 cwt
Barley	30 cwt	21 cwt	2·1 cwt
Swedes	20 tons	29 cwt	4·4 cwt
Swedes	30 tons	44 cwt	6·6 cwt

The S.E. (starch equivalent) and D.C.P. (digestible crude protein) yields are based on average quality hay and silage at the quoted yields. Two yields for

swedes are shown: a 20-ton crop, which is fairly average, and a 30-ton crop which it should be possible to achieve given the right conditions. It becomes apparent that swedes have great possibilities, outyielding barley, hay and silage in value of nutrients per acre.

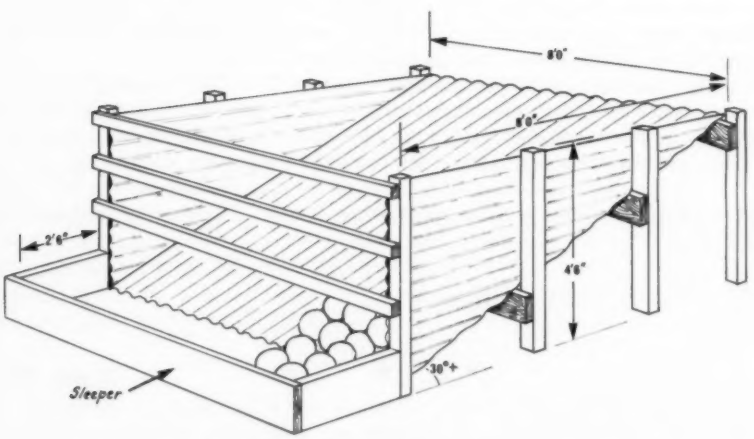
Swedes for cattle

Work at the Rowett Research Institute, Aberdeen (Dr. M. Kay, *Span*, 14.3.1971) has shown that a digestibility co-efficient of 80 per cent is obtainable with steers offered swedes *ad lib*. Due to the relatively soluble carbohydrate content of root crops the end products of fermentation are in similar proportions to those found when cereals are fermented in the rumen—thus roots and cereals can be considered complementary.

Dr. M. Kay has shown that 7-month-old steers given sliced swedes *ad lib* gained at 1·9 lb per day, whereas animals given *ad lib* barley gained at 2·3 lb per day. Both groups of cattle received a mineral/vitamin supplement. In these trials, steers given 33 per cent of their dry matter intake as swedes and 64 per cent as barley grew at a similar rate to those given barley alone.

In terms of the use of land resource this form of feeding (i.e., swedes and barley) provides an extra cwt liveweight gain per acre and the steers will reach slaughter at the same time as those with only barley. Increasing the proportion of swedes in the diet above 33 per cent lowers the weight gain achieved per animal but allows more weight gain to be produced from a given area of land.

The swede crop has a potential as a break crop and cattle feed, but the major drawback for many years has been the bottleneck at feeding. Traditionally fodder roots for yarded cattle were pulped and fed in troughs. Manually this is hard work since swedes are 90 per cent water. Various feeding carts and mobile root pulpers have been developed but every system involves at least some manual handling.



The A.D.A.S.–Walcot hopper

The A.D.A.S.-Walcot feeder

During the autumn 1970/71 Mr. J. M. Evans and his son John of Walcot, Lydbury North, Shropshire, who have grown swedes for many years for fattening lambs, bought a root-harvester jointly with a neighbour and fed whole swedes to fattening cattle. This proved to be highly successful. The swede crop had thus been mechanized to the point of utilization but feeding was still the bottleneck since whole swedes had to be carried in wheelbarrows from the clamp to the feed manger.

After discussion with local A.D.A.S. staff the idea of a self-feed hopper emerged. This would work on the principle of self-feed silage, i.e., for 24-hour access a 6–8 cwt beast would need about 4 in. of feed face and consume perhaps 35-40 lb of whole swedes; thus a yard of 20 cattle would require a hopper 7-8 ft wide, which would need refilling about once a week if it held 2½ tons of swedes.

One of these feeders was built from sawn sleepers, galvanized sheets, old fencing rails, split larch poles and coach bolts for about £12 and with 20 hours labour. This was positioned in a 9 ft gateway into a yard of 14 fattening cattle. The beasts consumed about 35 lb per day of whole swedes along with 10 lb of average hay and 6-10 lb rolled barley plus cattle minerals. This ration is sufficient to provide for a daily liveweight gain of 2 lb and is entirely home grown—no purchased protein is required.

This feeder was so successful that three more have been built. These are tucked into yards where they are filled once a week with a fore-end loader. Great interest has been shown in this system and farmers have written from all over Britain asking for details of the feeder and enquiring about the complete harvester.

Mr. J. M. Evans and his son have successfully integrated swedes into an intensive arable rotation to conserve soil fertility and maintain weed-free conditions. The crop is subsequently harvested and fed whole, with minimum labour, to the yarded cattle. This system has been pioneered in a livestock rearing area where grass acres outnumber cereal acres. Tradition dies hard in these areas and the root crop has survived as a cleaning break in arable rotations where consistently high cereal yields are not uncommon.

As a result of the simple but effective A.D.A.S.—Walcot feeder, could fodder roots have a place in the arable rotations of central and eastern England as a completely mechanized break crop?

In *Agriculture*, April 1966, C. Kinsey wrote 'For cattle feeding the main management problem now arises over the labour needed for indoor feeding. This is a problem which should not be beyond the wit of the engineer to solve'.

This problem appears to have been solved by a farmer and his son.

John Rhodes, B.Sc.(Hons), is Agricultural Advisory Officer in the Clun Valley District of Shropshire.

★ ★ ★

A rotary tandem parlour for a 500-cow herd on a farm east of Paris

Farm Buildings Association 1971 Tour of France

J. P. Harrison **P. D. Friend**

THE Farm Buildings Association was formed in 1956 and every other year it organizes an overseas tour for its members. Last year the tour was to France, consisting of a fortnight in early October divided between a week in the north and one in the south. The first part of the tour took place in an area between Boulogne and Troyes and the country southwards to Paris. During the second week, starting from Nimes, overnight stops included Arles, Avignon and Lyons before the return journey to London. Altogether twenty-seven farms or co-operatives were visited, with buildings for milk, beef and pig production, crop drying and storage.

The party was made up of people with varying specialist interests, but all were concerned in one way or another with the design of rural buildings. Among them were farmers, landowners, surveyors, architects and land agents. All found a lot to interest them and despite some language difficulties learnt a great deal from the tour.

The north

For many this was the first visit to the agricultural areas of northern France and there was some surprise at the large extent of uniform soil type found, running almost from the coast to Rheims. All this countryside, only very

slightly undulating, largely treeless and completely without hedges, is covered with a depth of some 2 ft of easily worked brown soil overlying chalk. Annual rainfall is about 30 in. The area is given over to arable farming and there are few animals to be seen, mainly dairy cattle on the smallest farms.

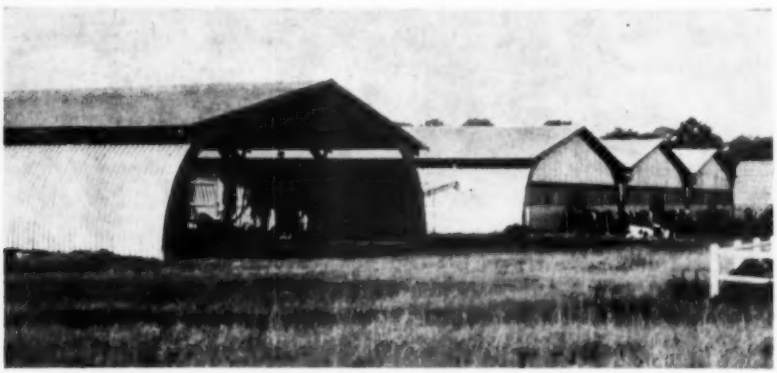
Hayricks built and dried mechanically in northern France

The summer months being, on average, warmer than in south-east England, grain maize is a major crop with barley and wheat of relatively less importance than in Britain. The harvesting of these two crops had been completed by the end of July, and when we were there sugar beet and grain maize were being harvested together. In the interval between the two harvests as much cultivation as possible had been completed and we saw the remainder following quickly after the harvesting of beet and maize, so that it looked as if by mid-October only potatoes would remain in the ground. The picture was of an arable harvesting and cultivating period spread over four months of reliable dry weather with no very great peak labour demand and all on an easily worked and well watered and drained soil.

Regional figures of farm size were not available, but the proportion of small farms did not seem particularly high and it was clear that there was a considerable development of co-operative ventures. In this countryside a

co-operative of any number of farmers may be set up to run a single enterprise, perhaps pig fattening or milk production, or it may run linked enterprises. Crop drying and beef production was a combination we saw twice and the buildings we inspected in the area included a high proportion of crop drying and storage plants.

Perhaps the most outstanding single enterprise seen during the first week was a unit set up for large scale production of lambs. Here, ewes were housed throughout the year and were fed on grass, beet pulp and lucerne nuts supplemented with grain and oilseed cake. There were two main buildings; the first was ventilated naturally and held about 300 ewe lambs for flock replacement, and the other, mechanically ventilated, housed 1,000–1,200 ewes with their lambs. The floors were of concrete and the animals were on straw, cleaning taking place twice a year. The larger building had four feed passages along its length, each with a row of pens on either side, with about 60 ewes with or without lambs in each pen at a little under 1 sq. metre per ewe. Most of the animals were of the Isle de France breed and all were reckoned to lamb three times in two years. In addition to the main buildings there was a separate feed mixing building and two tower silos holding dried lucerne and dried beet pulp, together with a hay barn. Feed was distributed to the troughs by side delivery trailers. The whole project was very impressive and had some unusual features.



Food mixing building (left) and covered yards for 400-cow herd on a farm west of Paris

Dairy units

In France, as in Italy, much of the dairy production comes from small farms, but both countries have recently seen the development of large specialized milk producing units which have attracted visitors from many parts of the world. Three of the units visited during the tour housed the cows in straw-bedded yards, and a fourth had stalls and cow traps. In each case the wide span portal-type structural framework was formed out of laminated timber. In Britain steel and concrete would, for economic reasons, normally have been used in comparable situations. The architectural effect of these frames, however, was very striking, and ventilation, where there were several adjacent spans, seemed effective and simple.

Feeding systems generally were based upon relatively cheap forage crops of maize and grass stored in massive steel-banded timber silage towers with all

concentrates and additives mixed into the manger-fed ration. Circular parlours are normal on these large installations, and they are very well equipped with generous areas of glazed tiling to walls and floors and with good lighting and space heating for comfortable working conditions.

Where such a heavy capital investment in buildings and stock is involved the need for exceptional management skills becomes paramount, and this was well illustrated in the largest unit seen, housing 800 Canadian Holsteins. It was hardly surprising to learn that since April 1968 an average of 400 visitors per month had been conducted around the unit and that it had become necessary to make a charge for this service.

Whatever the arguments for or against the concentration of farm production in this way, these large enterprises have demonstrated that technical problems can be identified and overcome. Conclusions about economic aspects are less easily drawn, depending as they do upon so many factors outside the control of the producer.

The south

The centre for Provence and The Gard is the old town of Nimes, so important in Roman times that an aqueduct, of which the Pont du Gard formed a part, was constructed to bring water from nearby hills. Water is still the key to the development and prosperity of the region, and twelve miles to the south of Nimes there has recently been built the largest pumping station in Europe, lifting Rhone water to irrigate an area of 325,000 acres.

The work of C.N.A.R.B.R.L., established in 1967 to plan and control the overall development of the Midi, has been described in detail elsewhere*. The area had many problems; fragmentation of holdings, reliance on single crops and lack of water being the main ones. The Corporation, set up by the French government, was given responsibilities for matters beyond these, including resettlement of nationals from Algeria, controlling the growing demands of tourism and the preservation of the unique delta land of the Camargue; an assignment which has already produced impressive results.

As part of its agricultural programme, the Corporation aims to increase livestock production and has set up new farm units on irrigated land. On two such farms, growing mainly wheat and maize, two sets of stock buildings were visited. Those put up for beef rearing were in timber, rather similar to low cost structures in Britain, and those for pigs were of a type of standardized prefabricated construction which we saw on many farms.

In areas where the Coroporation has had to purchase and break up larger estates which in the past had not been fully productive and use them for resettlement purposes, a typical size of unit might be 80 acres, and here production is generally intensive. Fruit, vegetables, tomatoes, vines, etc., are grown. In such cases the buildings provided cost, in 1967, around £10,000, and consisted of a fairly simple form of bungalow for the owner and a Dutch Barn type of structure with some living accommodation for a worker. As might be expected there are problems arising from any form of restructuring, but it was clear that the Corporation was aware of these and was planning accordingly.

Some indication of the growth of tourism can be gathered from a visit to

*_Farmers Weekly_, 20th March, 1970. 'Operation Lifeline; a description of the work of the Compagnie Nationale d'Amenagement de la Region du Bas-Rhone et du Languedoc'.

C.N.A.R.B.R.L. Dumont Pumping Station, near Nimes

Port Camargue, where a completely new development of 340 villas with harbour facilities for 1,500 boats has been constructed on an area formerly consisting of sand dunes. Each holiday dwelling has its own access to water, and has car space and every sort of modern equipment. There seems no reason to suppose that this development will not be a success.

The Camargue is famous for its bulls, its horsemen, and its prolific wild life. Not so well known, perhaps, is the fact that it now supplies 50 per cent of the French home demand for rice. The impact of agriculture on the ecology of the area has been considerable, while the pressures from tourism continue to increase.

Impressions of the tour

France is a large country, more than twice the size of the U.K. Its agricultural land accounts for nearly half of that within the six E.E.C. countries and nearly one-third of it is farmed today in units of 125 acres and over.

Any impressions gained in a rather hurried tour of two weeks in these circumstances must be very subjective and can hardly hope to give any valid interpretation of the farming management and systems in use. However, we were impressed by the high standard of the arable farming which we saw in the north; by the potential of the intensively cropped fruit and horticultural areas of the south; and the planned irrigation and resettlement projects. We had some opportunity of seeing something of the independent outlook and ingenuity of the farmers and workers on those farms which we visited and their positive attitude towards co-operation.

Last, but not least, we remember the hospitality and friendly reception we met throughout the tour.

J. P. Harrison, A.A.Dip., A.R.I.B.A., is Regional Farm Buildings Adviser, and **P. D. Friend, A.R.I.B.A.,** a Farm Building Adviser, both serving with A.D.A.S. at Cambridge.

Feed hopper and automatic drinker

Meat Rabbit Production

R. J. Parkin

ALTHOUGH rabbit production was encouraged during the two World Wars to convert kitchen and garden waste into protein, no attempt was made to produce rabbits intensively on the scale of a farm enterprise. The rabbits used were nondescript types and show breeds, producing lean and dark-fleshed carcases. Since myxomatosis appeared in Britain in 1953 considerable interest has been shown in producing domestic rabbits for meat. Present production on a farm scale involves white-fleshed rapidly growing rabbits with a high meat to bone ratio.

Little research work has been carried out involving fast-growing rabbits kept intensively in large numbers, and little genetic improvement has been made to the general run of those used for breeding. However, great improvements have been made in methods of production over the last few years, although intensive forms of housing and production have resulted in many setbacks for inexperienced producers.

In spite of the interest, the industry is not large. Over the last few years many new units have been set up, but within 18–24 months they have gone out of business due in the main to the fact that they have not made any profit; for this reason rabbit production has become known as the '18-month industry'. The bulk of the breedingstock used is not capable of standing the rigours of intensive production, or of producing meat type rabbits profitably.

Also, this enterprise requires the highest of husbandry skills and attention to detail, a quality rarely found in producers intending to 'get rich quick'.

To get rabbits into a cycle of production involves hard culling on initial stock, and because breeders also have to get used to a different environment, with changed management and feed problems, it is often eighteen months or two years before the enterprise can become profitable. This happens with other farming enterprises of course, but with rabbits many producers have expected to get a quick return for their outlay.

Breeds

The two main breeds of rabbits used for producing meat are the New Zealand Whites and the Californian. Both are white-fleshed, and improved strains are quick-growing, good food converters and give plump well-fleshed carcases. These breeds also have white pelts, a factor on which the packer insists. Improved strains of the breeds are available, but only in small numbers, and demand far exceeds the supply. Regretfully, much breeding-stock is bought which is not genetically capable of producing meat rabbits commercially. Other breeds are more often used in crossing, to transfer into a white-fleshed breed good points which it may possess. For example, the Dutch doe has been used to confer its excellent mothering qualities on a white breed. More recently hybrid rabbits have been specially bred for meat production; these tend to be superior to the general run of pure breeds.

Housing

The method of production most favoured in Britain is that of keeping does separately in rows of raised cages on a flat deck system. The faeces and urine accumulate on the floor beneath the cages, allowing for periodic cleaning. Each cage measures 3 ft $\times$ 2 ft and is made of galvanized welded wire. Modern labour-saving units have bulk feed hoppers, which are filled from

Interior of rabbitry showing flat deck cage system

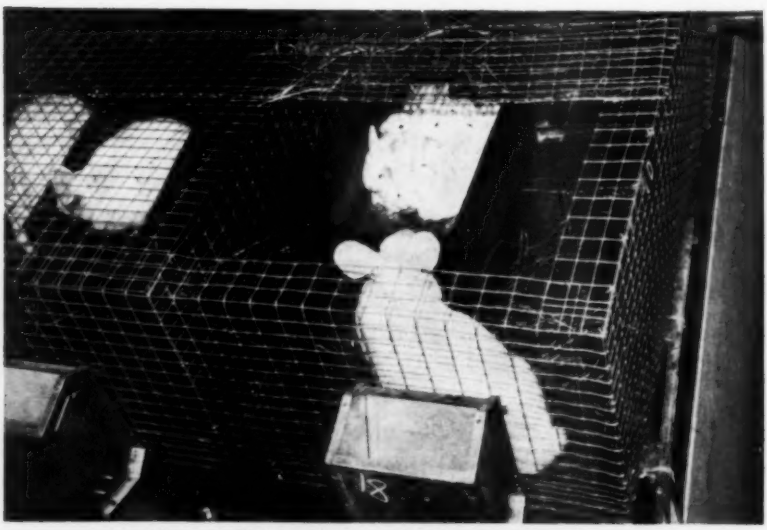
outside the cage, and automatic nipple drinking systems. Any type of building can be used for producing rabbits provided it is dry and free from draughts. Direct draughts can cause a lot of trouble, particularly to baby and young growing rabbits. Old lofts, cowsheds and poultry houses are often used and purpose-built houses can be purchased.

Production

Does are first mated at around eighteen weeks of age and have a gestation period of about thirty-one days. A nest box is placed inside the cage in which the doe builds a nest and places her newly-born young. The young usually remain with the doe until twenty-eight days of age, when they are weaned. They are reared together until a market weight of 4½–5 lb liveweight is reached at 10–11 weeks of age. Does are usually remated twenty-one days after kindling, enabling them to produce seven litters per year.

Post-partum mating, which involves remating the doe 3–5 days after she has kindled, has recently been practised by some producers. This is a practise which, if all goes well, will result in the doe having ten litters of babies each year. The size of litters varies but the aim is to produce eight or more marketable young per litter.

Feed consists of a balanced pelleted diet, high in fibre content. Most diets are designed to be used without hay, though some producers prefer to feed small quantities of hay or straw separately.



Feed hopper with doe and three-week old young in nest box

Of the many difficulties experienced in producing rabbits, one of the main problems is that of keeping the doe producing in the autumn months. Does often refuse to mate in the autumn and when they do they do not always conceive. Improvements in management and environment, particularly light and heat control, are tending to help in overcoming these problems.

Marketing and consumption

Some rabbits are killed and the meat sold by the producers but the majority are sold live to processors. There are a number of packers throughout Britain who buy in young live rabbits at 4½–5½ lb weight. The rabbits are killed by the packer, then skinned and paunched and packed for presentation to their markets. Rabbits may be collected by the packer or they may be delivered to the packer by the producers. Because of high transport and labour costs, packers prefer to pick up large quantities of rabbits at one point and pay a better price for quantities. Producers often form themselves into groups, taking their rabbits to a communal pick-up point, and qualify for higher prices as a result.

Oven-ready rabbit is sold fresh or frozen, whole or jointed in pre-packs, depending on the market outlet. Most rabbit sold here is frozen while the continental markets require the product both fresh and frozen.

After killing, skinning and paunching the saleable oven-ready portion represents, on average, some 53 per cent of the weight of the live rabbit. By-products, when there is a market for them, supplement the packers' income. Front feet may be sold for brooches and key rings and offal for inclusion in mink diets. Up to a year ago skins were bought by furriers, this being the reason for the white pelt requirement, but recently this outlet has become exhausted and skins are now virtually unsaleable except for animal protein, and at a very low price.

Size of industry

It is very difficult to determine accurately the size of the rabbit industry. Unlike poultry and other farm livestock, rabbits are not covered by the annual agriculture census forms of the Ministry of Agriculture, Fisheries and Food. The Commercial Rabbit Association, which represents the industry, claims to have only about 20 per cent of all rabbit producers as its members. From various surveys carried out by the C.R.A. and A.D.A.S. Poultry Advisers, it is estimated that the number of breeding does in Britain is about 100,000, owned by some 2,500 producers, each with an average herd of forty does. Only fourteen producers are known to have over 200 breeding does.

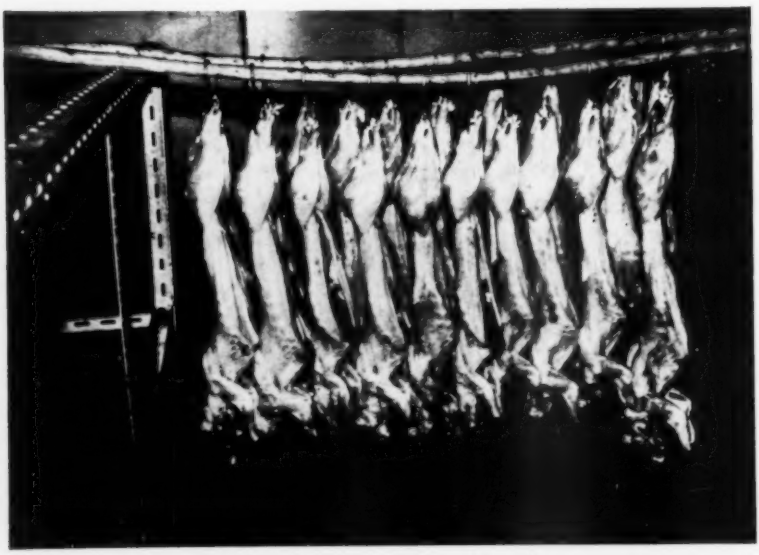
It can be seen then that commercial rabbit production is a small industry made up of small producers. Nevertheless, the C.R.A., sellers of breeding-stock and equipment and others playing an active part in producing rabbits all feel a more certain stability in the industry and movement towards consolidation and expansion. As problems of production are being overcome, units are becoming more efficient and are increasing in size.

Market potential

It has been estimated that there is a market potential of rabbit meat in Britain of some 100 million carcases per year. According to figures compiled by the Department of Trade and Industry rabbit meat consumption before the Second World War was about 3½ lb per head of population. This represented some 180 million lb of meat (or 90 million 2 lb carcases). It is likely that the estimate of 100 million carcase potential has been based on pre-war consumption. With myxomatosis and the resulting loss of the wild rabbit population, there was a considerable drop in the amount of rabbit meat consumed. Myxomatosis has also left behind it a strong consumer resistance to rabbit, this being

particularly so in the rural areas. In the towns and cities, however, there is a considerable demand for rabbit meat which is not at present being met.

Annual rabbit consumption in Britain is said now to be 0·5 lb per head of population. In 1970 imports were 205,514 cwt at a cost of £2,649,000; this came mainly from China, is a much redder meat than that produced at home and retails at a lower price. Meat wholesalers say they would prefer the higher priced home-produced rabbit if it could be supplied regularly and of a standard quality. Packers are as yet processing relatively very few rabbits. They cannot be guaranteed the number of rabbits they will receive because of problems associated with production, one of the biggest being that of the seasonal decline in production. In Britain rabbit is still regarded as a winter dish, but in the autumn and early winter, just when the demand rises, domestic rabbits do not breed so well. In the spring and summer, the best time for breeding, the packer has to have enough capital to be able to store rabbits until the demand increases; otherwise they have to be unloaded on to a low priced market.

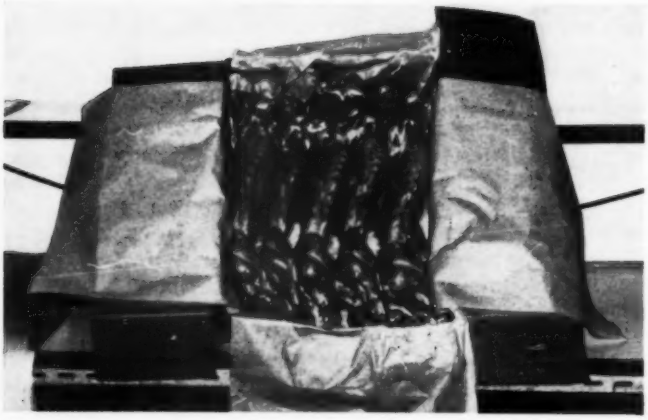


Freshly skinned carcases hung for cooling

Not all home-produced rabbit is consumed in this country; an estimated one-third of total production is exported to the Continent, where in contrast to Britain a vast quantity of rabbit is eaten. The French are said to eat 6kg (13·2 lb) per head per year, and the Italians and Swiss 1·2kg (2·6 lbs), at an average retail price of 50p per lb against an average of 32p per lb in Britain. A lot of imported rabbit entering Britain is promptly re-exported to the Continent; no figures are available because exported rabbit is classified by the Department of Trade and Industry as 'Game'.

The future

Once it has overcome production difficulties the rabbit industry would appear to have great potential. There would seem to be a good future for



Boxed, fresh whole rabbit carcases

rabbit in Britain if the prejudice against it can be overcome. Many of the big butchering and supermarket chains are already asking for home-produced rabbit in quantity, and in such large quantities that it is impossible for packers to supply regularly. Continental and other countries are continually asking for regular large supplies. But the tariff paid by E.E.C. buyers on imported rabbit means that the British producer receives a lower price than his E.E.C. counterpart. On entry into the E.E.C. a higher price will no doubt be achieved by the British producer, although feed prices may be higher; it could also be assumed that the rabbit we import could be replaced by 'home' production within the E.E.C. countries.

Although rabbit cannot compete in price with chicken, it could well find a place as an acceptable alternative in an intermediate price range below the cost of the higher priced red meats.

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ANIMAL HEALTH—RETURN OF PROCEEDINGS FOR 1971

The Return of Proceedings, under the Diseases of Animals Act 1950, for the year 1971 has been published by the Ministry of Agriculture, Fisheries and Food and the Department of Agriculture and Fisheries for Scotland.

It contains brief reports and statistical information relating to diseases of animals in Great Britain. Compared with 115 outbreaks of anthrax in 1970 there were only 64 in 1971. The Brucellosis (Area Eradication) Scheme was introduced into certain areas of Great Britain in November, 1971.

Copies of the Return of Proceedings may be obtained from H.M. Stationery Office, or through booksellers, price 10½p (by post 13p). A comprehensive report for 1971, which will include details of the work of the Laboratory Research and Investigation Services, will be published later.

A decade of purpose
and achievement of

The International Society for Horticultural Science

F. W. Shepherd

THE International Society for Horticultural Science is only just over ten years old but its roots go back for more than a century and its influence is already widespread and deeply effective in all countries where horticulture is important. It originated in the days when botany and horticulture were closely allied and, to use another botanical simile, the first pollen from which the Society developed was released in the mid-nineteenth century. The first fruit was ripened when more than four hundred delegates from thirteen countries assembled in Brussels at the time of an international flower show in April 1864 for three days of botanical and horticultural discussions.

In the twenty years which followed this first congress a dozen more combined botanical and horticultural conferences were held in the larger cities of England, France, Holland, Italy and Russia, often to coincide with large international flower shows. Thereafter, the botanical and horticultural congresses separated and the one held in 1889 in Paris is now regarded as the first International Horticultural Congress. From the start in 1864 each Congress was separately organized by the leading horticultural society in the host country and no formal international organization existed. The second International Horticultural Congress was held in Chicago in 1893 and although few foreign delegates were able to attend a determined effort was then made to form a World Horticultural Society; but little more than the announcement in the *Botanical Gazette* in 1894 seems to have survived.

Ten years elapsed between a congress in Ghent in 1913 and the next in Amsterdam in 1923, but with the active support of the host country an international committee for horticultural congresses was then formed with Dr. M. J. Sirks of the Netherlands as its first Honorary Secretary.

Society is formed

The subsequent struggles to develop a scientifically-based society are too complex to discuss in this short article but after an even longer gap as a result of the Second World War the English Royal Horticultural Society organized the thirteenth congress in London in 1952. There was then talk of a larger, more effective, international body and the fourteenth congress held at Scheveningen in 1955 accepted a resolution to extend the scope of the international committee to form an International Society for Horticultural Science; Dr. S. L. Mansholt, who was then Minister of Agriculture, Fisheries and Food in the Netherlands, offered hospitality to the headquarters of the new horticultural society. Such ideas develop slowly even within the boundaries of a single country, but when frontiers intervene time soon passes and

it was not until a meeting of the International Committee in 1959 that detailed proposals discussed at the 1958 sixteenth congress in Nice were accepted and the International Society for Horticultural Science was formed. The first I.S.H.S. Council meeting was held in Rotterdam in 1960 under the presidency of M. Roger Vilmorin, the distinguished French horticulturist. Representatives from eleven other countries, including the United Kingdom, were present, and observers were present or apologies recorded from half a dozen other countries.

The host country again offered assistance in the form of clerical and office facilities and Dr. G. de Bakker, who was already Secretary to the International Committee for Horticultural Congresses, was appointed Honorary Secretary, a post which he still retains. Mr. H. F. Waterschoot, also of the Netherlands, was appointed Editor and the first number of the I.S.H.S. journal, *Chronica Horticulturae*, appeared early in 1961. Mr. Waterschoot has continued to edit and publish three issues of this journal each year since then. The International Society for Horticultural Science has a membership which includes countries, horticultural organizations and individuals. Subscribers now include thirty-seven countries, about 150 organizations in thirty of those countries and some two thousand individual members in a total of 78 countries.

Policy and constitution

The policy of the Society is considered and guided by a Council consisting of a representative or representatives of all subscribing countries with a maximum of three from each. Britain is represented by the Senior Horticultural Adviser of the Ministry of Agriculture, Fisheries and Food, together with one each from the Royal Horticultural Society and the Horticultural Education Association. The President of the Council, and also of the Society, is elected in advance of each congress and is usually a senior representative from the country in which the congress is to be held. The Council normally meets at the time of the congress and at about two-year intervals between the congresses.

There is also an Executive Committee, consisting of the President, Vice-President, immediate past President, the Chairmen of Sections and Commissions and the Secretary General, which directs the Society in accordance with the general instructions of the Council.

The Society depends almost entirely on voluntary assistance and during the years of its development has debated the desirability of organizing its activities along the horizontal lines of the main disciplines concerned with horticulture, such as genetics, plant physiology and economics. It has, however, retained its vertical horticultural commodity divisions of the three main sectors of fruit, ornamentals and vegetables. There are also a number of Commissions covering such subjects as nomenclature, economics, protected cultivation, communications and plant protection. Both Sections and Commissions appoint working groups which meet for detailed discussions at and between the international congresses which are now held at fairly regular four-year intervals. The next congress is due to be held in Warsaw in 1974 and the one in 1978 is planned for Australia, the first to be held in the Southern Hemisphere.

Section, Commission and Group meetings are held both at the time of the congresses and in the years between and many of them have been valuable

opportunities for exchange of information on research and progress in commercial horticulture in all sections of the industry. Some examples of these meetings will illustrate the scope of the work of the Society and the benefit it has been to horticulturists throughout the world.

In the Fruit Section there has been much successful activity by the working group on nomenclature and registration of fruit cultivars under the chairmanship of Mr. J. M. S. Potter, former Director of the National Fruit Trials at Brogdale in Kent. The group has encouraged the work of identifying the cultivars of hardy fruits wherever they are grown and already this Ministry has published a definitive list of all cultivars of apples grown in this country which will later be merged into a larger international list. Working groups have met or arranged larger symposia to discuss such widely differing crops as apricots, raspberries, sweet cherries, plums, blueberries and mangoes.

A meeting with the Indian Horticultural Society took place earlier this year in Bangalore to discuss viticulture in the tropics, and growth regulators in fruit production are to be discussed at Minneapolis in August and Long Ashton in September.

The Vegetables Section has groups who have organized meetings to discuss such diverse subjects as the use of peat in vegetable production, vegetable nutrition and fertilization, the timing of field vegetables, weed control in vegetables and vegetable storage.

The Bulbs Group of the Ornamentals Section held a very successful symposium in August 1970 in Holland which was attended by 164 scientists from fourteen countries including advisory, experimental and research officers from this country. Another successful event in this Section was the symposium on pot plants which was held at the Research Station for Floriculture at Aalsmeer in November 1971.

Of the Commissions, that for horticultural economics has organized two meetings, first at Reading and then in France to discuss both the working methods and collected information on horticultural economics in several countries where horticulture is important. A third meeting is planned to take place in Wageningen in September 1972.

The author of this article arranged a session at the XVIth Congress in Brussels in 1962 to discuss the problems of liaison between research workers, teachers, advisers and the industry they serve. Subsequently, as Secretary and now Chairman of the Commission on communications, ideas were exchanged in correspondence and at the XVIIIth Congress in Tel Aviv. Such matters are less tangible than the results of research or the economics of production and this Commission has not yet made the progress that others have done.

The Commission on Horticultural Nomenclature and Registration grew out of a series of older committees which had been involved in the production of the International Code of Nomenclature for Cultivated Plants which was published by the Royal Horticultural Society in 1953. This was later modified after consultations with agriculturists and foresters and published by the International Union of Biological Sciences. The Code provides considerable assistance to those concerned with the proper identification of cultivated crops, a matter of no little importance when one cultivar can be so much more successful than another of close similarity and the choice of the right one can mean the difference between profit and loss to the grower. The word cultivar is a newly-coined word meaning cultivated variety to distinguish such plants from wild or natural varieties. It is being more and more widely used, particularly in the ornamentals and fruit sections of the horticultural industry.

This I.S.H.S. Commission now keeps the successive editions under review and encourages the appointment of International Registration Authorities for Horticultural Plants.

Publications

The main papers read at these various meetings are published in technical communications under the general title *Acta Horticulturae*. More than twenty such detailed publications have now been issued or are in the course of preparation, and they provide comprehensive accounts of the subjects under discussion.

These reports of the meetings of the Society augment the regularly produced Bulletin, *Chronica Horticulturae*; three issues have appeared each year for eleven years and, in addition to news of the Society's activities, past and planned, have carried articles of general horticultural interest from many parts of the world. A considerable part of the Bulletin has been devoted to a series of articles on horticultural research in which the research institutes of many countries have been listed and their work described. A single volume was produced in 1966 with the title *Horticultural Research International*; this included up-to-date information about horticultural research and research workers in the twenty-three countries so far covered in the Bulletin. Plans have been made to add a second volume, or to produce an enlarged and revised edition.

International congresses

Although much of the work of the Society is now undertaken by the various Sections and Commissions through their working groups the successive international congresses are the most publicized activities.

The various congresses attended by the author since the Second World War have followed a fairly well established pattern, one which is probably similar to many other international conferences—a welcome by the Minister of Agriculture or some other leader of rural life in the host country, followed by receptions by the Head of State or other high dignitaries and banquets of high quality and adequacy, are the gloss on the hard work and deep interest which is required. The Dutch method of conducting their banquets is recalled with interest, the Royal Toast following the soup and a whole range of toasts follow the successive courses to spread the intake of material and mental fare over several hours of the evening and night.

During the congress three or four major subjects are addressed to the whole gathering, often numbering a thousand or more. These sometimes survey the trends and results of horticultural and botanical research in one of the countries where it is extensive and varied. More specific subjects have also been surveyed in some depth as when the control of vegetative growth and reproduction and the effect of temperature on plants were discussed in 1955. Plant hormones, the culture of plant cells, the controls of flowering, science and the weather and more general surveys of the horticultural and international scene have all been dealt with over the years and now make interesting reading in the bound volumes of reports of the congresses.

The congress then divides into smaller groups and, while not all have provided the precision of the Dutch at the 1955 Congress, it is then possible for scientists and horticulturists to make maximum use of their time.

At the 1955 Scheveningen Congress the organizers aimed at dividing the days into what Professor S. J. Wellensiek, the Dutch Congress President, described as a 5 × 5 Latin square. There were five main divisions of horticultural production: vegetables, fruit, floriculture, arboriculture and tropical crops which were to be the vertical divisions. The five main disciplinary divisions of breeding and propagation, soils and fertilizers, diseases and pests, environment and engineering provided the five horizontal divisions. The lectures and discussions on each subject were so arranged that, for example, a horticulturist interested in floriculture could attend successive days of meetings concerned with the five separate disciplines affecting his subject while at the same time a horticultural engineer could attend successive meetings as his subject was discussed by the five horticultural divisions.

Inevitably there are some problems, such as when a popular subject takes place in a tiny crowded hotel lounge or a less attractive session is billed for a vast theatre. One recalls a large hall in Nice and a German speaking in his native language into a powerful microphone with ample loudspeakers, while the two simultaneous translators spoke their French and English versions into a system which emitted it seemingly one from each side of the headphones provided. There is disappointment too, like when the Eastern research worker who was billed to speak on the influence of music on plant growth failed to appear at successive congresses.

Some papers have a very considerable influence on horticulture; when mist propagation was first discussed internationally in 1955 and nurserymen, research workers and experimenters rushed back, at least to this country, to install such systems and to transform the propagation of ornamental plants.

Some subjects appear to be more neglected than they might be; for example, the vastly important work which was reported at the last congress in Tel Aviv by a research worker from India who is studying the chemical content and cultivation potential of Dioscorea, a variable genus, some of which produce a chemical which forms the essential element of the 'pill'.

Continued expansion

The slow development of this International Society for Horticultural Science from 1864 to 1960 has now given way to a very considerable expansion. If, as we can expect, the enthusiasm of the individual horticulturists in many countries in the world and the dedicated efficiency of the small secretariat in the Netherlands continues, we can see this Society continue to expand and develop and make its influence felt on horticulture all over the world. For its smaller meetings and large congresses, its regular journal and detailed reports it is worthy of the individual support of horticulturists and horticultural scientists in all sectors of the industry.

F. W. Shepherd, N.D.H.(Hons.), F.I.Biol., was until recently the Ministry's Senior Horticultural Adviser.

Maize Leaflet

Single copies of the Ministry's leaflet S.T.L. 93 *Maize–Production for Silage and Grain* may be obtained from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT

Maize crop on the East Riding College of Agriculture farm at Beverley

Maize in the North

M. D. Alder

THERE has recently been a revival of interest in the maize crop in this country. In 1970 an estimated 10,000 acres were grown, 2,000 for grain and the rest for silage. There is every reason to believe that this acreage will double in the next two years and there might be an extension of the crop in the north of England; there the potential of maize must be as a forage crop because grain maize production requires the accumulation of a number of 'corn heat units' which cannot be acquired in this area and cannot for that matter be guaranteed further south.

It is a commonly-held view that maize cannot be grown north of a line from the Severn to the Wash. An information leaflet published by the Grassland Research Institute in 1970 suggested that whilst varieties may be available in a few years' time that are better adapted to cooler regions, for the time being maize was unlikely to be a reliable crop north of the Midlands. High Mowthorpe Experimental Husbandry Farm, situated on the Yorkshire Wolds, have stated that after three years' experience with the crop they have been sufficiently encouraged to continue in their study. At the East Riding College of Agriculture a small acreage of the crop yielded well enough to encourage an expansion of the acreage in 1972 which is to include a number of agronomic trials designed to be of benefit to northern growers. Although both High Mowthorpe and the College have successfully grown the crop neither would feel they are in a position to fully recommend its growing to local farmers. There are a number of farmers in the north of the country who

have tried growing maize with mixed success. Mr. C. Frank farms on the North Yorkshire coast near Scarborough and provides an example of a farmer who firmly believes in the future of the crop. In 1971 he grew 120 acres which he is expanding next year to 150 acres; the state of the maize at harvest appeared to justify the commitment.

Cleaning effects of maize crop due to use of atrazine herbicide

Guidelines for northern growers

The crop is in the trial stages in the north of the country. It is a sub-tropical crop growing in a marginal region and therefore if success is to be obtained very careful attention must be paid to certain husbandry factors.

In order to obtain a satisfactory crop a suitable site should of course be selected. To obtain maximum sunlight and heat, a site facing south is desirable. Shelter is also important because wind damage can occur on the periphery of the crop under exposed and windy conditions. A free draining deep loam soil is required with a pH of 6 or above. If the crop is grown in a light soil, the maize tends to be shorter and therefore yields less.

Having selected a suitable site, a variety suited to northern conditions must be found. The National Institute of Agricultural Botany carry out trials on maize varieties suitable for silage maize; these are divided into early and medium maturing groups, the most promising generally coming into the early group. Varieties in this early group should normally be chosen for northern conditions and of these Anjou 210, Caldera 535, Kelvedon 59A and Dekalb 202 have all done well.

Northern growers may well have to sow the crop later than their southern counterparts. Maize will not normally germinate in temperatures below 10°C (50°F) and though late sowings may lead to yield reductions, early sowings will not lead to early emergence if the soil is cold. In the north, the first week in May provides the best sowing conditions in an average season. It is important too that the crop should be harvested at the correct stage in order to obtain top quality silage of good dry matter content. This means

waiting until the grains begin to dent at the tip and are at a 'firm, cheesy' stage inside. The best time for harvest normally occurs in late October.

The rest of the crop's agronomy is standard. Seed rate for silage is around 45 lb/acre, seedbed preparation should be thorough and the crop normally drilled on a width that suits the harvester, e.g., 30 inches. Fertilizer application is normally at the rate of 5 cwt of a 20 : 10 : 10 compound, and weed control is simple and effective with an atrazine-based herbicide. One problem that has troubled many growers is the damage caused by birds in the 2–3 weeks following crop emergence. Stringing the field with black terylene thread in 40–50 yard squares has sometimes proved effective and should be combined with other measures such as bangers, scarecrows, dead birds and dusk and dawn patrols. Bird damage is a serious threat and can result in failure.

The case for maize

Following the guidelines given, a successful maize silage crop could be grown in the north of the country. The case for growing such a crop must now be put. Maize compares favourably with other fodder crops:

Crop	Harvest period	Yield in tons per acre (metric tons per hectare)			Dry matter content %	D-value	Crude protein*
		Green	Dry	Digestible organic matter			
Silage maize	Sep./Oct.	20 (50)	4·2 (10·5)	2·9 (7·3)	21	68	9
Fodder radish: Later flowering type ..	Various	16 (40)	1·6 (4·0)	1·0 (2·5)	10	63	21
Rape	Sep./Nov.	12 (30)	1·4 (3·5)	1·0 (2·5)	12	67	23
Flat poll cabbage	Oct./Nov.	24 (60)	2·4 (6·0)	1·7 (4·3)	10	71	22
Kale: Marrow stem	Oct./Dec.	24 (60)	2·9 (7·3)	1·9 (4·8)	12	66	16
Normal thousand head ..	Jan./Mar.	17 (43)	2·7 (6·8)	1·8 (4·5)	16	65	17
Dwarf thousand head ..	Jan./Mar.	16 (40)	2·4 (6·0)	1·7 (4·3)	15	70	18

*As percentage of dry matter. *(Reproduced by kind permission of N.I.A.B.)*

It is usual to compare maize silage with grass silage and here again the comparison is favourable. A 20-ton crop with a 21 per cent dry matter can be expected from maize, which therefore compares favourably with grass cut four to five times a year and well fertilized. The *in vitro* 'D' value of such material should be 68–70 per cent which could be obtained by cutting grass at ear emergence. The maize crop therefore gives a high yield of digestible energy, but it must be remembered that its protein content is low. Variable

costs are higher for maize silage (£18/acre for maize silage; £12/acre for grass silage) but producing a ton of starch equivalent equates at around £7.

The potential yield of dry matter obtainable from maize is higher than that from grass. In other words it is arguable that the same dry matter could be produced from a lower acreage of maize. The acreage released could be utilized by other crops which could be counted against the cost of maize production. Atrazine used on maize exercises a good deal of control over grass weeds; this may lead to increased yields from subsequent crops. This cleaning effect is a further economic argument for growing maize.

Maize need not compete with grass; it can complement it. In the north drilling could be delayed until the middle of May which would allow for a cut of grass silage to be taken prior to drilling. There is also a possibility of including maize in a zero grazing system where a small acreage would provide a high yield at the end of the season when grass production is in the decline.

Maize as a break crop

Maize growers in the arable north-east of the country (Lincolnshire, the East Riding and parts of the North and West Ridings of Yorkshire) are looking for a suitable break crop—maize could well suit their purpose. The maize crop exercises a good degree of control over the build up of soil-borne fungal organisms; in cereals the organisms causing the diseases take-all and eyespot are soil-borne and would be controlled by a maize break.

Perhaps the main advantage of maize is that it gives unrivalled opportunity for control of weeds. A chemical in the triazine group of herbicides, usually atrazine, is used at normal application rates (3 lb commercial product/acre) and this will deal effectively with all broad-leaved annual weeds. If couch control is the objective then the application rate is 8 lb of commercial product per acre. A fact often ignored is that atrazine has a residual effect in the soil. Following spraying for annual weed control a minimum interval of seven months must elapse before a following crop is sown. This can restrict the rotation, since it will not always be possible to follow maize with a winter crop, particularly winter oats, which are very susceptible to atrazine. After applying atrazine for couch grass control the crop in the following calendar year must be maize and a minimum of eighteen months from the time of application must elapse before a different crop is sown.

Feeding trials have indicated that maize silage is comparable to grass silage in beef production and that it can also be valuable in dairy and sheep feeding. In the north the crop is grown for silage and will therefore require stock use. There is little future for the crop on all the arable, non-stock farm, unless such a farm were to introduce stock.

Maize can be successfully grown in the north of the country, but if a high yielding crop is to be obtained it must not be forgotten that it is essentially a sub-tropical crop and must therefore be treated with respect in terms of correct management and husbandry. At the present stage of its development it would probably be premature to recommend northern farmers generally to move into silage maize production. But the experience of pioneer growers and the results of trials in the north should be watched with interest.

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The P.G.R.O. Research Station

The Pea Growing Research Organisation

A. J. Gane

THE very substantial increase in the acreage of peas in general, and of dried peas in particular, during and immediately after the last war, led to the formation of the Home Grown Threshed Peas Joint Committee, a body which, with an increasingly wide sphere of activity, has become the Pea Growing Research Organisation, or 'P.G.R.O.'. The original Committee was formed to foster, and to provide, applied research and advisory services to improve the growing and harvesting of dried peas; while this aim remains, similar services have been added in relation to vining peas (1956) and both broad and dwarf beans (1963).

P.G.R.O. is supported almost entirely by voluntary levy, which is paid equally by growers and by the first purchasers of their produce. This means, in effect, that half the levy is paid by the primary producer and half is paid by canners, quick-freezers and merchants. This joint support for the Organisation is typified also by the constitution of the Board of Directors; six Members are nominated by the National Farmers' Union, two by the National Association of Frozen Food Producers, two by the Fruit and Vegetable Canners' Association and two by the Pea Pickers' & Pea Packers' Association.

In addition to the levy, income is also received in the form of subscription under the Associateship Scheme, which is open to those in this country who

are not eligible to pay levy and to the nationals of foreign countries too. Membership of the Scheme currently extends to sixteen countries overseas.

Applied research

Field trials and experiments are the principal activity, and are carried out on a wide range of subjects which are of practical interest and concern to the industry; seventy trials were carried out in 1971, half of them on the trial ground at the research station, and half on farms, ranging from Lincolnshire to the south coast.

The research programme is tailored according to the needs of the growers, processors and merchants, whose suggestions and comments are invited annually, and this is in fact the first in a series of actions and reactions which together typify the depth of approach which is made.

Perhaps a plant breeder suggests that he has a new line which he feels is interesting, but of which he does not yet wish to release details. A confidential assessment will be made by P.G.R.O. If he wishes to develop the variety further, he may submit it for inclusion in the national series of pea variety trials, planned jointly with N.I.A.B. and F.V.P.R.A., the results of which are seen by virtually every processor in the country. In turn, growers will have the opportunity of seeing the variety in the field, on the annual Open Days; and processors will in addition have the opportunity of examining and tasting the produce of such a variety, canned and frozen in the Organisation's processing laboratory, on Canners' or Freezers' days, and will be provided with samples for further assessment in their own laboratories if required.

In addition, every processor has the opportunity of discussing any new variety, privately, and in detail, and of obtaining advice on its suitability for his pack and for growing in his particular area. Finally, he will be advised on its integration with other varieties.

The advantages of many of the currently leading varieties of vining peas first became apparent in these trials in the mid-1960s, and at the present time there are more new varieties being assessed which clearly offer distinct additional advantages. In fact, the use of improved varieties has made an outstanding contribution towards raising yields, increasing viner throughput and improving reliability. The selection of more determinate varieties, of even maturation and with no excess of haulm, which are resistant to such common and debilitating diseases as downy mildew and pea wilt, and the produce of which is of comparable if not superior quality, is of obvious value to the grower, the processor and the consumer.

Whereas ten years ago such varieties as Meteor, Kelvedon Wonder, Surprise, Lincoln and Dark Skinned Perfection were in the forefront, we now think far more in terms of Dart, Recette, Sprite, Scout, Hurst Green Shaft, Puget and others, while even newer varieties such as Sparkle and Hurst Beagle are showing promise.

A wealth of new material becomes available, and the established national trial series provides thorough and independent assessment, the results of which are aimed at saving each individual processor the time, trouble and expense of carrying out all the preliminary work, and merely leaves him to make the final selection, with personal guidance.

Similar 'services in depth' are provided in relation to the assessment of new herbicides, insecticides and fungicides, and the many other facets of production which together form the husbandry of the crops concerned.

The Organisation has for many years played a leading part in the assessment of herbicides; in particular it has been involved in the independent evaluation of virtually every material recommended for use in peas in this country, and in the nature of the detailed advice governing their use.

Growers inspect new pea varieties on Open Day

Efficient weed control is essential, as is efficient control of pests and diseases, but clearly the economics of crop production are now such that the financial implications of each proposed treatment, or lack of treatment, must be carefully weighed as never before. It is against this background that only the most precise advice is good enough.

Specialization in comparatively few crops has its distinct advantages. Individual biological problems can seldom be satisfactorily treated in isolation. So often the partial solving of one problem exposes another, or a series of others, and it is often only those who are constantly active in the appropriate sphere who have the opportunity of continuing to follow the trail.

An outstanding example of the 'chain reaction' which is initiated by applied research has been that which has developed from what began as a study of the influence of seed rate on the yield of vining peas. This was followed by an exhaustive investigation of 'spatial arrangement', or plant population and its distribution, which was found to influence yield considerably. The importance of being able to establish the optimal number of plants per unit area led to studies of seed and its reliability, the influence of such seed disorders as low vigour, hollow heart and marsh spot, and while this work is continuing, it is already abundantly clear that new knowledge, of practical value, has been gained from each and every subject concerned.

All aspects of the production of vining peas, dried peas, broad beans and dwarf beans come within the current scope, and in many cases P.G.R.O. experimental work has brought about radical changes, such as, for example, in the manuring of dwarf beans, on which subject the findings reversed previous practice.

The applied research programme in fact provides a continual probing of pea and bean growing, and has resulted in a continuing contribution towards increasingly efficient production.

Specimens on view on Open Day

Lines of communication

Since research may so easily be misdirected in the absence of adequate contact with those it is intended to benefit, and since the results of research itself will not automatically influence the practices of growers or processors, every effort must be made to tailor the research programme according to the needs of the industry to promote the dissemination of results, advice based upon results, and to encourage the exchange of information. Every available method must therefore be employed, such as talks and conferences, press articles, leaflets and the like.

P.G.R.O. Conferences provide an opportunity to hear groups of speakers on recent developments and, at the same time, an opportunity to meet many people with similar interests, with all the advantages of contact-making which only such events provide. Talks are given anywhere, on request, to groups of growers or others; private short-courses are held on request, too, at the research station for groups of farm managers or groups of company personnel, when an agreed programme of lectures and other activities is provided, well supported by visual aids.

There is a conscious effort to maintain a realistic approach, to take into account the economics of crop production in relation to experimental work, to present results in a practical way, and to give sound advice firmly. Liaison, both internal and external, is essential if the object of applied research is to be achieved.

The implementation of the results of research takes time. It is often years before growers take full advantage of new techniques, although pea and bean growers appear to do so quicker than most.

Part of the machinery display on Open Day

Articles in the farming and technical press and a wide range of leaflets have gone far to achieving the required aims, while the new P.G.R.O. Handbook provides more up-to-date information on British pea growing than has previously been brought together in one volume.

In addition to what might be termed these 'educational' activities, advisory work in the more conventional sense is also a P.G.R.O. activity, the demand for which has quadrupled in the last five years. Almost eight hundred enquiries were dealt with in 1970, the greatest number being in relation to pests, diseases and disorders, many of which involved laboratory work on samples and specimens. Every subscribing grower, processor, merchant and associate is encouraged to make full use of this service, the purpose of which is to answer practical problems, with positive advice, quickly.

Enquirers are encouraged to submit material to the station when possible, but farm and factory visits are made whenever necessary.

Cost effectiveness

Inevitably, applied research costs money, but expenditure by P.G.R.O. is both minimal and widely spread, so that even in present conditions the contributions called for from individuals, companies and institutions are modest.

In 1970, for example, the small P.G.R.O. team carried out 65 trials and experiments from Lincolnshire to the South coast, dealt with nearly 800 advisory enquiries, produced 33 publications, gave 22 talks, held 3 symposia and provided short-courses for over 200, with a total expenditure of £27,000.

The Organisation is thus a clear example of self-help, in that the provision of independent applied research and advisory services has been achieved for over a quarter of a century almost entirely on the basis of voluntary support by those for whose benefit its activities are designed.

The author of this article, **A. J. Gane, C.D.A., F.R.M.S., F.R.S.A.,** is the Director of Research at the Pea Growing Research Organisation.

Apple and Pear Storage in Kent

D. B. S. Fitch, *Lands Arm, A.D.A.S., Guildford*

MOAT FARMS (Kent) Ltd. is one of a group of farms east of Tonbridge run by Mr. Adrian Scripps. Farming and horticultural enterprises include hops, top and soft fruit, potatoes and other arable crops. There is also a sheep flock.

In 1967 Mr. Scripps decided to expand his fruit storage facilities and began an extensive study of existing traditional and sectional type fruit stores in this country and on the Continent. After about two years of research and planning, the latter part of which was occupied with obtaining Local Authority consents and approval of applications for grant under the Horticulture Improvement Scheme, he went ahead with the building of four pear/apple stores, each with a capacity of 100–125 tons.

Siting, layout and design

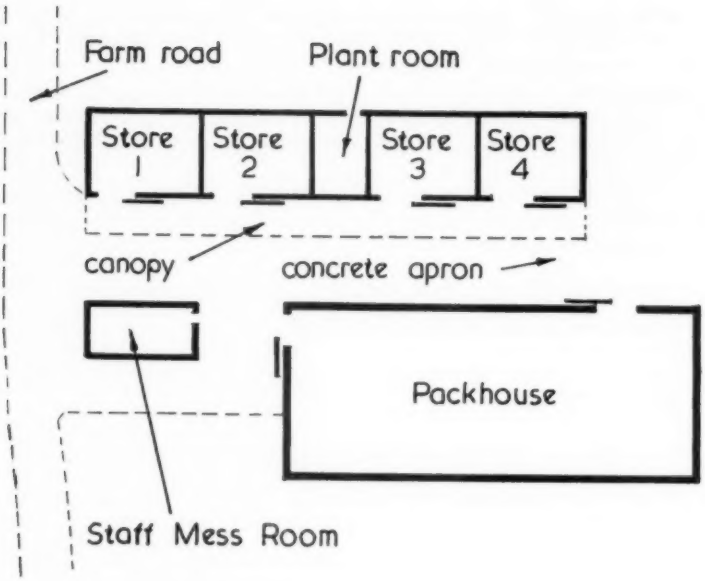
The site selected was on unused ground opposite to a concrete framed building which has now been adapted for use as a modern pack-house. There was good access from a main farm road and adequate space for the extension of a hard-standing for manoeuvering fork-lift trucks and lorries. There was also room for expanding the stores at a future date.

It was necessary to carefully calculate the size of the stores in relation to the bulk bin system of handling the fruit. First, therefore, a loading plan for the bins was prepared and this showed what measurements the stores should be so as to achieve the minimum waste of space. In addition, the plan enabled the extra large doors and cooling towers to be correctly positioned.

For convenience the four refrigeration units (one for each store), together with the temperature and gas recording equipment, were grouped together in a plant room measuring 24 ft × 16 ft, centrally sited with two stores on either side. Louvred openings were provided on the back and front wall of the plant room as well as a ventilated ridge in the roof to allow for plenty of fresh air to get to the refrigeration units to ensure that they would work efficiently and not overheat. It was designed so that at a future date it could be easily converted into a store when, if this were done, the plant would be rehoused in a new building adjoining the back of the stores.

Construction and materials

It was in the construction of the store that the greatest savings in cost appeared possible. The advantages and disadvantages of construction with prefabricated materials and purpose-made insulated panels as against traditional forms of construction were carefully weighed. The final decision was for a mixture of the two methods, a choice influenced by a desire that as much work as possible should be carried out with direct labour and local skilled tradesmen. Mr. Scripps already had experience in erecting various farm buildings on some of his other farms.



FRUIT STORES AND PACKHOUSE

The prefabricated section consisted of a steel framed building 24 ft wide × 144 ft long, i.e., 9 bays each of 16 ft. It was roofed with corrugated asbestos and along one side a canopy was provided to give weather protection over the doors to the stores.

For the remainder of the store a more traditional method of construction was used. The 11 in. cavity walls were constructed of 4 in. of brickwork on the outside and 4 in. of insulation block inside, while partition walls were in insulation block-work 8 in. thick. Special care was needed to maintain the cavity wall around the stanchions of the steel framed building.

The inside faces of the blockwalls were then given a thin coat of sand/cement rendering in readiness for two coats of vapour seal. A seal was also applied to the ceiling and floor. The floor was insulated with slab cork 2 in. thick and the same thickness of polystyrene was fixed with a 'hot dip' adhesive to the walls and ceilings. A second layer of 2 in. polystyrene was then applied to the external walls and ceilings to give them an overall thickness of 4 in. of insulation.

To control the inside atmosphere the stores had to be 'gas'-sealed and when deciding how this should be done Mr. Scripps was able to apply some of the knowledge he had obtained from his visit to the Continent. Sheets of fibre-glass (delivered in rolls) were fixed to the walls and ceiling with a water-based plastic vinyl paint. When the paint had dried two more thin coats of paint were applied and a hard, smooth finish obtained. If at any time the seal should become damaged it would be quite a simple operation to patch up

the damaged area in the same way as the seal had been put on in the first place. To reduce the risks of mechanical damage a large concrete kerb was provided around the base of the walls.

All fruit handling is by means of fork-lift trucks. The floor, therefore, had to be reinforced in order to carry the weight of these trucks when loaded. In addition, it was provided with a hard-wearing dust-free industrial type of surface.

The stores took about nine months to build. Careful planning before work started kept costs down and the final gross cost amounted to £26,200 for 21,600 bushels of storage.

Field Beans as a Break Crop

A report on field beans as a break crop has been published by the Department of Agriculture and Horticulture of the University of Nottingham. It brings together the results of a survey undertaken jointly by the Universities of Cambridge, Nottingham and Reading and co-ordinated by the University of Nottingham.

The report is based on an economic survey of the 1968 and 1969 crops on more than a hundred farms in the Eastern, East Midlands and Southern regions of England. Data for the spring and winter crops have been separately analysed and gross margins for each region and for both years are given.

The report shows that the average gross margin per acre for spring beans on all farms in the survey was £23·00 in 1968 and £25·20 in 1969. There was considerable variation between farms both within regions and between years with an average gross margin per acre for the top 25 per cent of farms in 1968 of £33·73 and in 1969 of £31·38. Apart from the Eastern region in 1968, where the report indicates a low gross margin, there was little variation between the other regions in 1968 and the three regions in 1969. In general, the average gross margin per acre for winter beans showed greater variation both between regions and years. For winter beans on all farms in the survey it was £18·76 in 1968 and £31·53 in 1969. The 1969 average was influenced to a considerable degree by the high yield in the Eastern region where the average gross margin was £38·18 per acre.

In addition to the financial results, the report examines labour and machinery requirements for both spring and winter beans in each of the regions and also investigates some husbandry practices.

This study is the tenth in the series of co-ordinated economic investigations published under the title 'Agricultural Enterprise Studies in England and Wales', which are being undertaken by University Departments of Agricultural Economics and supported by the Ministry of Agriculture, Fisheries and Food. The views expressed and conclusions drawn are not necessarily those of the Ministry.

Field Beans as a Break Crop, by W. S. Senior, can be obtained from the Department of Agriculture and Horticulture, University of Nottingham, School of Agriculture, Sutton Bonington, Loughborough, Leics., LE12 5RD, price 30p.

Colorado Beetle in 1971

During 1971 a single Colorado beetle grub was found in some potatoes taken on as ships' stores in Spain but, for the ninth year in succession, neither beetles nor grubs were detected in commercial imports of early potatoes (totalling about 570,000 tons) from countries where the beetle occurs. The last significant incidence of the beetle in potatoes was in 1962, when some eighty beetles and grubs were found in Italian potatoes from areas in the province of Campagna in which it was certified there were currently no known infestations. These examples indicate how effective the regulatory controls have been and what can happen when they are not applied carefully.

In most years beetles are picked up from crops, materials and transport having no direct connection with the pest's development. Those in late spring or summer are undoubtedly associated with the flight periods of the beetles at these times of the year. The earliest finds of the year have usually been on salad crops, and are before the normal flight periods, including those in areas where the beetles develop earliest. These salad crops have probably been planted after infested potatoes; when the over-wintered beetles have emerged from the soil they have found the salad crop suitable as shelter, though not attractive as food.

In 1971 three beetles were found during the months January to March; in endive from Spain and France, and in lettuce from Belgium. April drew a blank, but in May fourteen beetles were found at Southampton on a cruise ship which had called at Lisbon. On eleven other ships, fourteen more beetles were picked up during the months May to September.

The increase in uninterrupted movements of freight containers and vehicles to bases inland improves the chances of the Colorado beetle reaching agricultural land. 1971 saw the first reported discoveries (three beetles) inside freight containers—from Portugal and Switzerland.

The total discoveries in England and Wales for 1971 comprised thirty-seven beetles and one grub. Details are as follows:

Number of bettles	*Probable origin*	*Source and date of find*
3	Belgium	lettuce (March), ship (August), aircraft (June)
2	France	endive (March), ship (September)
1	Italy	cherries (June)
1	Netherlands	vehicle parts store (September)
1	Poland	ship (June)
22	Portugal	ships (May, July), aircraft (August), dock (August), container (September)
3	Portugal or Spain	ship (August)
3 (plus 1 grub)	Spain	endive (January), ship stores (June), ship)August)
1	Switzerland	container (August)

No breeding colonies were found during the year.

Colorado beetle in Europe

An upward trend in infestations in 1970 in the Cotentin region of France was reported by Mr. Janson (*Agriculture* April 1971, p. 161). A further rise in this region, together with much damage to late potato crops, was recorded in 1971. The European and Mediterranean Plant Protection Organization has ceased to report annually on Colorado beetle in member countries, and there is as yet no confirmation of our impression that the recent rise in incidence is not restricted to the Cotentin. January and February 1972 yielded six beetles on imported salad crops, compared with a total of only three found during the corresponding months for the three-year period 1968–71. It is clear that the public and the Ministry should maintain their watch for Colorado beetle.

The Ministry is greatly indebted to those who reported the presence of suspected beetles in 1971 and asks for similar co-operation in 1972.

P. Aitkenhead,
M.A.F.F. Plant Pathology Laboratory, Harpenden

Autumn sowing, from a coloured aquatint, 1818

Just reminiscing . . on work and tools of the corngrower before machines replaced

Plough-team, Sickle and Flail

Nigel Harvey

IN principle, the routine of the corngrower has changed little over the centuries. As it was in the days of King Alfred, so it is today—he prepares the seedbed, sows his seed, controls the weeds, harvests and threshes the corn. But the modern farmer lives and works in the modern world and uses equipment and machinery made available to him by the scientific, industrial economy which lies beyond the farm gate. His ancestors knew nothing of this; they were dependent on local resources and local ingenuity. The tools and implements they used bear impressive witness to the skill they applied to the development of effective means of meeting the demands of the exacting crop upon which their lives depended.

Digging-stick to plough

The first of their tasks was, of course, the preparation of the seedbed, always one of the most laborious and crucial operations of the corngrower's year. Once upon a time the land was broken by the digging stick, used in the same way as a modern hoe, or by the more efficient pointed stick which was thrust through the soil by the weight of the man behind it. Neither of these tools did more than scratch the soil at immense cost in human labour. Then some unknown genius at some unknown time harnessed to these pathetic implements an ox instead of a man so that they were pulled by animal power

instead of being wielded or pushed by human muscles. Thus was achieved one of the major technical triumphs of history, the creation of the *ard*, the first form of plough.

Like the digging-stick, the *ard* merely scratched the soil, but it did so more quickly and with much less human effort. It also made possible the systematic cross-ploughing which raised a better tilth than the old stick-system and produced in the process the little square fields of the early peoples which are still visible on the chalklands of southern England.

Later, in a second revolution, another unknown genius added a mould-board to the *ard* and so created the modern type of plough which cuts, raises and overturns the soil. Primitive forms of plough lingered on in the remote areas—a form of hand-plough was in use on Skye within living memory. But in the arable lowlands the change was complete by Saxon times. 'As I go, it is green on one side and black on the other. What I tear with my teeth falls by my side', says the plough in the Saxon riddle—so it has been down the centuries. The surviving ploughs of our forefathers tell us much about the evolution of particular types for particular circumstances, about the use of different materials, the application of scientific principles to their design and the replacement of the village craftsman by the factory. But they are all variations on an accepted theme, recognizable descendants of their ancient prototype.

Agricultural scene, from Hockham Bible Picture Book, c. 1330

Seedbed and sowing

Seedbeds are not prepared by ploughs alone. Our ancestors used farm-made harrows similar in principle to our own, sometimes drawing them by one corner so that the tines did not follow in the same furrow. In their simplest form, these were merely hurdles through which brushwood was woven.

Others were timber frames fastened by nails or wooden tines, sometimes weighted by a block of stones to secure penetration. For centuries, however, human arms and wooden beetles or mauls helped to break down clods on the more obstinate soils. Heavy cylinders are difficult to manufacture in a village workshop, though tree trunks with iron spikes driven into them or iron rings bound round them were sometimes improvised and, according to tradition, a Roman milestone spent some of its long life rolling cornfields. But it was only at the end of the eighteenth century that horse-drawn rollers finally replaced the manual clod-breaker.

Sowing remained for long a literally manual job, but few men can now remember the measured tread of the sower who went forth to sow and the rhythmic casting of the seed to left and right. The hoppers and the seed-lips in which the grain was carried are now found only in museums; so, too, the seed fiddle, operated by a disc turned by a bow, which was sometimes used to simplify the sower's task and the dibbling sticks with which in the days of cheap labour farmers sought to secure regular planting. The spread of the drill was slow, but its triumph was complete. Among the tools it made obsolete were the slings and clappers of the birdscaring boy, cold and lonely in the winter fields. Broadcast corn was harrowed in, but it was far more exposed to pigeons and crows than seed planted deep and covered by drill.

Use of bagging-hook at Hereford, c. 1900

Pre-mechanical harvest

Weeding, which was by handhoe, gave few problems but needed much labour. The true testing-time came at harvest, when the whole village community was mobilized for the most demanding of farm operations. The corn was cut by scythe or sickle, the latter sometimes in conjunction with the bagging-hook, and then bound into sheaves with ropes woven from straw. It was stooked to dry and finally carted to ricks which were in due course roofed by the thatcher, whose craft is a subject in itself. The scene is familiar from countless pictures. No artist, however, has portrayed the aching muscles, worn fingers, frayed tempers and haunting worry over weather

which were the lot of the old harvesters. It is not surprising that the harvest was ended with noisy celebration, when men bore from the field with uncomprehending ritual the mysterious last sheaf in which their forgotton ancestors had seen the dwelling-place of the corn spirit, and followed by the traditional feast in the barn.

In the months after harvest, however, the barn changed from a place of feasting to one of dreary labour for those pitiful human machines, the flailers, who thrashed on average only three or four hundredweight of corn in a long and exhausting day. Wearing boots without nails to avoid splitting the grain, they generally worked in pairs, striking alternately with the yard-long beater rods attached to the handstaff by joints made of a collar of green ash and a loop of leather or eel skin. Their steady thumping was one of the traditional noises of the pre-mechanical countryside in wintertime and villagers said that they could tell by the sound how the work was paid—a slow, dull beat announced 'by the day, by the day', a brisker rhythm, meant piece-work, 'we took it, we took it, we took it'.

Threshing, from an engraving by Richard Westall, c. 1800

The thrashed grain was then winnowed in the draught created by opening the central doors of the barn to separate grain from chaff and headcorn from tailcorn. Sometimes a shovel was used, sometimes the winnowing fan, a large flat two-handed basket in which the corn was first shaken to bring the chaff and heaviest grain to the surface before it was thrown across the barn floor. Finally, after a further winnowing or sieving, the grain was ready for storage or market and the corngrower's year was over.

An appeal

Only two or three lifetimes ago, these tools and many others, such as sheafbarrows and cornscoops, hummelers for removing barley awns and strikes for levelling bushels, were as common and familiar as, say, telephones, ballpoint pens and cigarette lighters are today. But now the few that survive are carefully preserved in museums. We should remember, however, that

farming history is a matter for farmers as well as historians and there may be relics of the past on your farm.

If you come across any such survivals in barn, outbuilding or attic, please tell the keeper of your local museum or of the Museum of English Rural Life at Reading. In so doing, you will be helping to preserve something of the past for the benefit and interest of the future.

Nigel Harvey, M.A., A.R.I.C.S., was on the staff of the Ministry and of the Agricultural Research Council before joining the Department of the Environment. He has written various books and articles on farming history.

★ ★ ★

Ministry Publications

Since the list published in the April 1972 issue of *Agriculture* (p. 183) the following publications have been issued.

MAJOR PUBLICATIONS

DEPARTMENTAL PUBLICATION

Blueprint for 200 Sow Unit. *Available only from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT* (New) 45p (by post 52½p) (*Not for re-sale*)

TECHNICAL BULLETIN

No. 19. Farm Planning by Computer (New) £1·50 (by post £1·57½) (SBN 11 240919 9)

OUT OF SERIES

Annual Review and Determination of Guarantees 1972. (Cmnd No. 4928) (New) 24p (by post 26½p) (SBN 10 149280 4)

FREE ISSUES

ADVISORY LEAFLETS

No. 107. Black Leg of Potatoes (Revised)
No. 263. Tomato Leaf Mould (Revised)

SHORT TERM LEAFLET

No. 93. Maize (Revised)

Priced publications, unless otherwise stated, are obtainable from Government Bookshops (Addresses on p. 234) or through any bookseller. Single copies of free items are obtainable from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT.

Cenarth Falls, a popular tourist attraction

8. South Cardiganshire

Twynog D. Davies

THE area south of Llangrannog to the river Teifi, locally known as the Teifi-side district, is unique in many ways and undoubtedly contains some of the best agricultural land in Cardiganshire. Although two-thirds of the county lies above the 500 ft contour, Teifi-side is predominantly undulating lowland country. Along the western fringe, the sea, with its rugged coastline and sandy beaches, attracts thousands of visitors annually. The tourist industry has grown in importance over the last decade and its present contribution to the overall economy of the area cannot be over-emphasized. Hamlets and villages, situated at the end of wooded glens, are found along the coast where there has been a break in cliff formation. These include such places as Tresaith, Penbryn and Cwmtydu, which are now established popular tourist centres. The other areas of tourist and historic interest are Mwnt and the Cenarth Falls. The ancient medieval church of Mwnt is situated by the sea and overlooks a sheltered sandy beach. At present a service is held there only once a year, but at one time it was used as a meeting place for pilgrims to pray before sailing across the sea to Bardsey Island. The Cenarth Falls are picturesque in

themselves, with the salmon leaps an added attraction to visitors. Along the river Teifi, coracle fishing and racing are popular pastimes.

Up until the last century, Aberporth and Cardigan were important ports, and materials such as lime and timber were imported into the area. Cardigan at that time had a large ship building yard but this now has been replaced by light industries. With a population around 4,000, Cardigan provides the natural trading and market centre for the agricultural community of South Cardiganshire and North Pembrokeshire. Although the area is devoid of large industries, the R.A.E. and R.A.F. stations at Aberporth provide around 1,000 jobs and some small part-time farmers are employed.

South Cardigan is predominantly Welsh speaking—Welsh being the language of the home and the market. Over the last fifteen years, newcomers from over the border have purchased farms in the locality where lower land values and ideal climatic conditions have been an attraction. These farmers, strangers to the area, have settled well into the community and have greatly appreciated the kindness, hospitality and friendship shown by the local people.

Soils and drainage

With the exception of a narrow coastal strip where the soils are formed on glacial sands and gravels brought in by Irish Sea ice, all the soils of the area are developed on parent materials of local origin derived from Ordovician shales and grits. The valley slopes consist mainly of free-draining brown earths, while shallow, excessively drained soils predominate on the valley tops. River alluvium or boulder clay, often poorly drained, covers most of the valley floors.

All the soils are naturally low in lime and phosphate and the shallow soils are also very responsive to potash dressings.

Agricultural pattern

The climate, with its mild winters and adequate rainfall of 40-50 in. per annum, provides ideal conditions for grass growth. The pattern of farming is thus based on livestock production with dairying being the most important enterprise.

The area at present carries around 13,000 dairy cows, an increase of over 4,000 in the last ten years. The size of herds, however, remains relatively small and of the 455 dairy farmers in the district, 378 produce milk from herds of under 40 cows, 68 from herds of between 40-70 and only 9 producers from herds of over 70. The pattern of production and progress is obvious in that many of the existing 40-cow herds will eventually increase to around 60-70 cows, although this will not be achieved without considerable sums of capital being spent on buildings.

Apart from milk production other important enterprises include heifer rearing, store cattle production, pigs and corn. There is considerable emphasis at present for farmers to rear their own replacements because of the high prices being demanded for dairy cows. Furthermore, as a result of South Cardigan being in the brucellosis eradication area, the demand for accredited stock could be considerable in the future.

Although the trend is to reduce the number of breeding sows, weaner production still plays a major role in the economy of many farms in the

locality. Around 14,000 weaners are marketed annually through the Emlyn Weaner Group which supplies pigs to fatteners in the Midlands. Other groups are also in operation in the area.

About 6,000 acres of corn are grown, but this is confined mainly to the coastal belt. The district of Verwig, which originally derived its name from the 'Barley field', contains some of the best corn land in the area. Despite transport difficulties, brewers at one time bought a large tonnage of malting barley from this area.

Cardiganshire has always been renowned for its export of teachers, preachers and pigs—this still holds true today.

The family farm

In view of the fact that only 150 of the 720 farms in the area are of over 600 SMDs* it is obvious that the family farm is the main unit of production. The majority of farms are owner-occupied and few become available on rent.

While referring to the family unit, it is worth mentioning that in the Verwig area there is an entire Williams family of seven brothers and two sisters, all actively engaged in farming within a three-mile radius of one another. Between them they farm 1,300 acres and all are engaged in intensive milk production. This must surely be a situation unparalleled in British farming today.

Technological progress on the South Cardigan farm has been immense over the last decade. Bulk tanks are rapidly replacing churns and a high standard of controlled grazing is being practised widely by leading graziers; the large number of farmers nominating AI bulls for long term dairy herd improvement is encouraging. It is only by readily accepting new technology that the seventies can be faced with confidence. It is clear that the Teifi-side farmer is well equipped to meet the challenge.

*SMD—Standard man-day. One SMD represents 8 hours of manual work for an adult male worker under average conditions.

Twynog D. Davies, B.Sc., is an A.D.A.S. Agricultural Advisory Officer stationed at Cardigan.

The next few issues of *Agriculture* will include articles on: feeding the modern layer; a report on the January 1972 Oxford Farming Conference; turkeys; farmers of Halifax and the Calder Valley; silt and sand management for horticultural crops; cage rearing of early weaned pigs, etc.

in brief

- **Carrot spectacular**
- **Slurry and a sewage system**

Carrot spectacular

FIGURATIVELY speaking, the British have taken the carrot to their hearts. Who would have thought that this weed of Southern Europe, first noted in our records in the late sixteenth century, would by selection evolve into one of our most important vegetables, ceding place only to potatoes and cabbage in vegetable consumption? And 90 per cent is home grown, with an annual output valued at £7 million. Since 1950 the acreage has increased by 25 per cent (since 1960 by 12 per cent) to a total of 40,000, giving a production of 550,000 tons in 1969/70, which is 60 per cent higher than the 1950 figure and 40 per cent higher than that for 1960—a spectacular growth indeed.

The commodity study* of this crop, prepared by W. L. Hinton, of the University of Cambridge, in conjunction with the Universities of Leeds, Manchester and Nottingham as the sixth in the Agricultural Enterprise series, is clearly important, not only for the present evaluation of the economics of production and marketing of carrots in Britain, but for future possibilities, including the effect of marketing within the E.E.C. In the latter connection the report envisages 'little immediate prospect for Britain to export fresh carrots to the E.E.C. countries, but there is no reason why a certain quantity of finger carrots should not be produced in time for this purpose and to save imports. There are good prospects for trade in processed carrots because our production costs are so low compared with those of the E.E.C.'

The importance of the merchant in our carrot production amply justifies the detailed chapter devoted to it. These specialized dealers sprang from the expanding market in Britain, both for fresh carrots and carrots for processing, and indeed they have in their turn been responsible for much expansion. An analysis of carrot acreages managed by merchants shows 49 per cent to be grown in partnership with the farmer, mainly in the Chatteris area of Cambridgeshire. Imports of luxury finger carrots have to some extent slowed up the production of prepacked finger carrots for supermarkets in Britain. 'The potential is there', says the report, 'but it has yet to be realized'. The report adds that too little attention is being given to the marketing of carrots, largely the result of concern with the traditional market crop. 'The carrot needs a modern image in the modern market, otherwise as affluence increases it could become an inferior food . . . A few years ago the Ministry of Agriculture decided that research on carrots lagged behind that on other vegetables. Processors were becoming more interested in the crop and prepacking was becoming more important. The demand for a more precise product suggested more precision in production techniques. Consequently, a comprehensive research programme is under way which should have an impact in the next decade. It includes all factors affecting quality, yield and continuity of production.' Developments and current research are looking at different types of pack, a flexible (plastic) package in which clean carrots ready for cooking are vacuum packed at a cost comparable with that of the canned pack, and dehydration, which removes 93 per cent of the

*_The Economics of Carrot Production and Marketing in Britain_. price 50p, incl. postage, from the Agricultural Economics Unit, Dept. of Land Economy, Cambridge University.

weight and so provides another outlet for the large carrot. Given the new image visualized by this study, there is no doubt that the carrot has come to stay.

Slurry and a sewage system

IT IS an unsavoury but inescapable fact of life that without prevention or remedial action people and pollution are inseparable. The higher the population and the correspondingly greater concentration on the need to meet its requirements for food, housing, goods and services, the higher is the potential pollution risk. So when Mr. J. M. Rablah, writing in this year's *Great House E.H.F. Review*, remarks that 'clean rivers are not only to look at but to drink', he is saying succinctly what many treatises on the conservation of our water resources and many exponents of a clean countryside have said at great length. Despite the poetical attention given to them, it is not to be supposed that all our rivers and streams have hitherto run crystal clear and sweet; the Thames was for long London's sewer, and other main rivers were little better as they became all too convenient receptacles for the waste by-products of industry and sewage from growing towns.

Today's problem of keeping our water resources unpolluted is therefore one of degree, intensified by new production techniques among which the disposal of wastes and effluents arising from modern farming practice presents formidable difficulties, both practical and economic. Washing-down water from an intensive dairy unit can, of course, be kept separate from the main bulk of slurry, but if this effluent is to be put on to the land in areas of high rainfall, much of it may in some circumstances be washed off the surface, or light lands may not filter the liquid efficiently so that some effluent ends up in a river or stream. This effluent, although diluted by washing-down water and rainwater, is still likely to be five times stronger than domestic sewage! This raises the question whether it is feasible to treat farm effluents in sewage systems of the type used for domestic wastes. Several different processes for treating slurry are under trial at various centres to determine whether the principles of sewage disposal could be applied effectively and economically to farm wastes, and Great House is also investigating a system whereby the solid fraction is settled out, leaving the liquid to be further treated.

'Unfortunately,' says Mr. Rablah, 'this solid will retain 10-30 times its weight of water. This is still a bulky material and the only practical method of dealing with it is to apply it to the land. By taking the solids out of, say, a pig slurry, about 90 per cent of the potency is removed. Despite this, the liquid that is to be treated is still six times stronger than domestic sewage or eight times that of settled sewage. The soluble and colloidal matter which remains in the liquid will require further treatment. This will be done by transferring it to a second tank and then aerating and agitating the mixture by a paddle mechanism. Treated in this way it is expected that the slurry from washing down the shippon, collecting yard and parlour will, after settlement, be fit to discharge into a stream. The liquid from the piggery aeration tank will be passed into a further settlement tank and then discharged into a stream, public sewer or lagoon, depending on the efficiency of the process'.

A free copy of the current *Review* will be sent to interested readers on application to The Director, Great House E.H.F.

AGRIC

ACKNOWLEDGMENT OF PHOTOGRAPHS

We gratefully acknowledge permission to use the following photographs:

Cover, Eagle Photos. P. 189, *Shropshire Star and Journal*. Pp. 193, 194 and 195, P. D. Friend. P. 197, J. P. Harrison. Pp. 209 and 210, M. D. Alder. Pp. 213, 215, 216 and 217, Pea Growing Research Organisation. Pp. 222, 223, and 225, University of Reading Museum of Rural Life. P. 224, Hereford City Library. P. 227, Twynog D. Davies.

Books

Insect Pollination of Crops. J. B. FREE. Academic Press. £7·25.

This 544-page book, more than any other, indicates to the reader the value of insect pollinators in the production of so many of man's crops.

Part I covers the types of insects chiefly involved; the honeybee, bumblebee and solitary bees are given separate treatments. It is an opportune time for such a comprehensive work to appear. The number of honeybee colonies continues to decline in Britain and there is inadequate information available on the status of wild bees. In all parts of the world changing agricultural techniques, particularly in the use of pesticides, can be a hazard to pollinating insects. Positive efforts to protect beneficial insects can come only from a scientific understanding of their importance; this book provides it.

Beekeepers will find comfort in the positive aspects of cross pollination mentioned in the introduction. Plant breeders will see some of their research work designed to overcome the deficiencies of insects where numbers are too low to effect satisfactory pollination. The failure of some autofertile breeding programmes indicates the need for more understanding of the whole of this fascinating subject.

Part II covers the crops; twenty-two families are given chapter status and, as would be expected from their economic importance, the Papilonaceae rate five chapters and the Rosaceae three. Beekeepers will doubtless focus their attention on the chapters dealing with the crops that contribute to honey production in the various regions. The crop coverage is universal with *Rutaceae* (Citrus), *Sterculiaceae* (Cocoa) and *Anacardiaceae* (Mango) being just a few tending to the exotic. The family style presentation of Part II inevitably makes it of a reference nature, but it is still very readable.

It is unfortunate that some of the floral diagrams lack impact and in some cases the small size masks the detail. The size of presentation is variable and no scale is included on the diagrams. Botanists may not mind this but others may find it annoying to have to search the text to discover the size of flowers in relation to insect visitors and their role in achieving pollination.

The price of the book reflects the quality presentation of paper and binding. Tables have been kept to a minimum but are highly relevant, while the fifty-two pages of references serve to label this a comprehensive work that will be difficult to surpass.

P.W.

The Economics of Farm Waste Disposal. STEPHEN WILLETTS. University of Surrey. 50p.

The author of this typewritten report is a graduate student at the University of Surrey who is preparing for a PhD degree. The subject of his research and ultimate thesis will be the Economics of Farm Waste Disposal and he hopes to graduate in 1973.

Stephen Willetts's interim review is a literature study of the available papers up to about 1970 and was prepared during the early stages of the author's work. Mr. Willetts has studied Ministry of Agriculture Fisheries and Food literature, research and conference reports and has obtained some data by private correspondence and discussion. His paper deals with all types of livestock waste and other foul drainage that originates in and around farm buildings. The literature concerned with land disposal as well as sewage works type treatment plants is examined.

Mr. Willetts reports that the removal and land disposal of the droppings from 1,000 battery laying chickens can cost £20–£35 per annum whilst disposal by contractor may be £40 per annum or more. Thermal drying costs may be £5–£17 per ton of dry solids. A range of costings for various methods of handling cow manure is also given.

This paper does not report any original research and is clearly presented on an interim basis until the author has completed his more detailed studies. Nevertheless it does offer a very useful summary of the present published facts, and is a convenient reference for those concerned with the costs and methods of effluent disposal. No separate bibliography is included in the text.

Copies of the report can be purchased direct from Mr. Willetts at the Department of Humanities and Social Sciences, University of Surrey, Guildford, Surrey.

K.B.C.J.

Rabbits and their History. JOHN SHEAIL. David and Charles, 1971. £2·75

This book is a useful historical account of the semi-wild and completely wild European rabbit in Britain from its introduction in the twelfth century, the establishment of managed warrens from the thirteenth century onwards up to the great reduction in the rabbit population brought about by myxomatosis in 1954/55.

About a third of the book is concerned with rabbits kept in warrens and their value as producers of fur and meat. Besides fur for hats, all parts of the rabbit were used: tails, ears, feet, trimmings of skins as manure for fruit, hops and potatoes while skins were also used for gloves, size, gelatine and jujubes. Rabbit meat appeared at medieval banquets from the thirteenth century, was held in the seventeenth century to be equal in value to grouse or partridge and became by the 1870s a cheap, abundant popular food. After 1800 warrening ended as the home meat market was supplied by gin-trapped rabbits and rabbits from Australia, New Zealand and Europe.

The history of the rabbit as a 'game' animal is also interesting. From the fifteenth to the late eighteenth centuries rabbits living wild, outside the warren, were regarded as inferior game and some naturalists doubted that they would survive without the protection of the warren. During the late eighteenth and nineteenth centuries there was more interest in pheasants, partridges, hares, and fox-hunting and a growing association, especially in East Anglia, between rabbits and game estates such as Sandringham and Elveden.

As the size of shooting parties increased, rabbits were often necessary to swell the 'bag'. The cereal depression in the late nineteenth century led to a fall in value of arable land and the income from shooting became higher than that from the millers.

The inhuman anti-poaching laws of the late eighteenth and early nineteenth centuries were gradually reformed and the presence of rabbits was regarded as a symptom of derelict land and poor husbandry. This did not prevent 'rabbit farming' during subsequent agricultural depressions but the shortage of food during 1914–18 and 1939–45 and the campaign against the cruelty of the gin trap, finally resulted in a general appreciation of the need for rigorous rabbit control enforced by legislation.

The author has read the reports of Select Committees and Royal Commissions and scrutinized the voluminous literature on rabbits, including the files of the County Record Offices, with commendable industry. As a well-selected historical review the book is good, but too much has been included on the ecology of the rabbit and not all the statements are accurate. The practice of listing references at the end of each chapter, rather than collectively at the end of the book, leads to repetition and makes the checking of an authority more laborious. The short quotations at the beginning of every chapter are not always apt and that at Chapter 6 perpetuates an error.

H.V.T.

The Study of the Soil in the Field. 5th Edition. G. R. CLARKE, assisted by P. BECKETT. Clarendon Press: Oxford University Press, 1971. £2·50.

It is particularly appropriate that the fifth edition of this book has been published at a time when there is more than usual interest and concern about the effect of present-day farming on soils. Anybody who develops more than a passing interest in soils will find this book invaluable in studying and understanding such a complex material and they will soon appreciate the author's comment that 'Soil Scientists should realize that the story of a soil is told by an examination of its natural environment'.

The layout of the fifth edition is similar to previous ones but there is much more information on the use of aerial photography and on systems of soil evaluation. Unfortunately the author makes no mention of the land use capability system now adopted for assessing land potential in this country as a combined approach between the Soil Survey and the Agricultural Development and Advisory Service. He also fails to mention the system of soil structure evaluation devised by Peerlkamp in the Netherlands; this is unfortunate for the technique has proved of merit in this country and is easily practised.

For the agriculturist the biggest weakness of the book is undoubtedly its failure to make worthwhile agricultural interpretation of soil properties that are recorded and to satisfactorily analyse the influence of the farmer as an agent of pedogenesis. However, in spite of these weaknesses the book includes a wealth of experience gained over many years which have been, and will continue to be, of great value to students of the soil.

D.B.D.

History of British Agriculture, *1846–1914.* Second Edition. CHRISTABEL S. ORWIN AND EDITH H. WHETHAM. David and Charles, 1971. £4·20.

The year 1846, which saw the end of thirty years protection of home-grown corn production, indicted Peel for political apostasy and raised the curtain on 'the terrible crisis of free trade', is one of the watersheds of Britain's agricultural history. It is therefore a particularly appropriate date from which to examine the fortunes of farming and rural economy during the following half century and its aftermath which terminated with the First World War. This was the period of the greatest fundamental change when, first under the gathering impetus and later the consolidation of the Industrial Revolution, a dichotomy of interests cleft town and country and, apart from a few halcyon years in the early 1870s, farming was debilitated by natural calamities and the mounting flood of agricultural produce from overseas. It was also the period of the rise of farm worker's unions within a context of political and social awakening and the decline of the landed interest which had set the pattern both of national government and local authority for centuries; and it was in 1889 that bureaucracy and democracy made common ground in the establishment of the new Board of Agriculture, whilst concurrently agricultural research and improvement societies were feeling their way towards a new era.

This, broadly, is the terrain which the authors traverse in some detail to give an objective study of the period from which subsequent political, economic and social thought can be said to have arisen. Whilst Lord Ernle has long stood astride the field of English agricultural history, the past fifty years have seen a marked expansion of research and recording in this hitherto little regarded sphere of the British story. Moreover, Lord Ernle's account is confined to England, which excludes much of interest and importance to the full understanding of the evolution of British agriculture. Thus Christabel Orwin and Edith Whetham's book, now in its second edition, which takes as its canvas the whole of Britain and has the advantage of perspective interpretation of the events occurring within its selected period, is a worthy companion to stand beside the older great work.

S.R.O'H.

Agricultural Chemicals Approval Scheme

There are no Additions or Amendments to the 1972 List of Approved Products for Farmers and Growers this month.

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